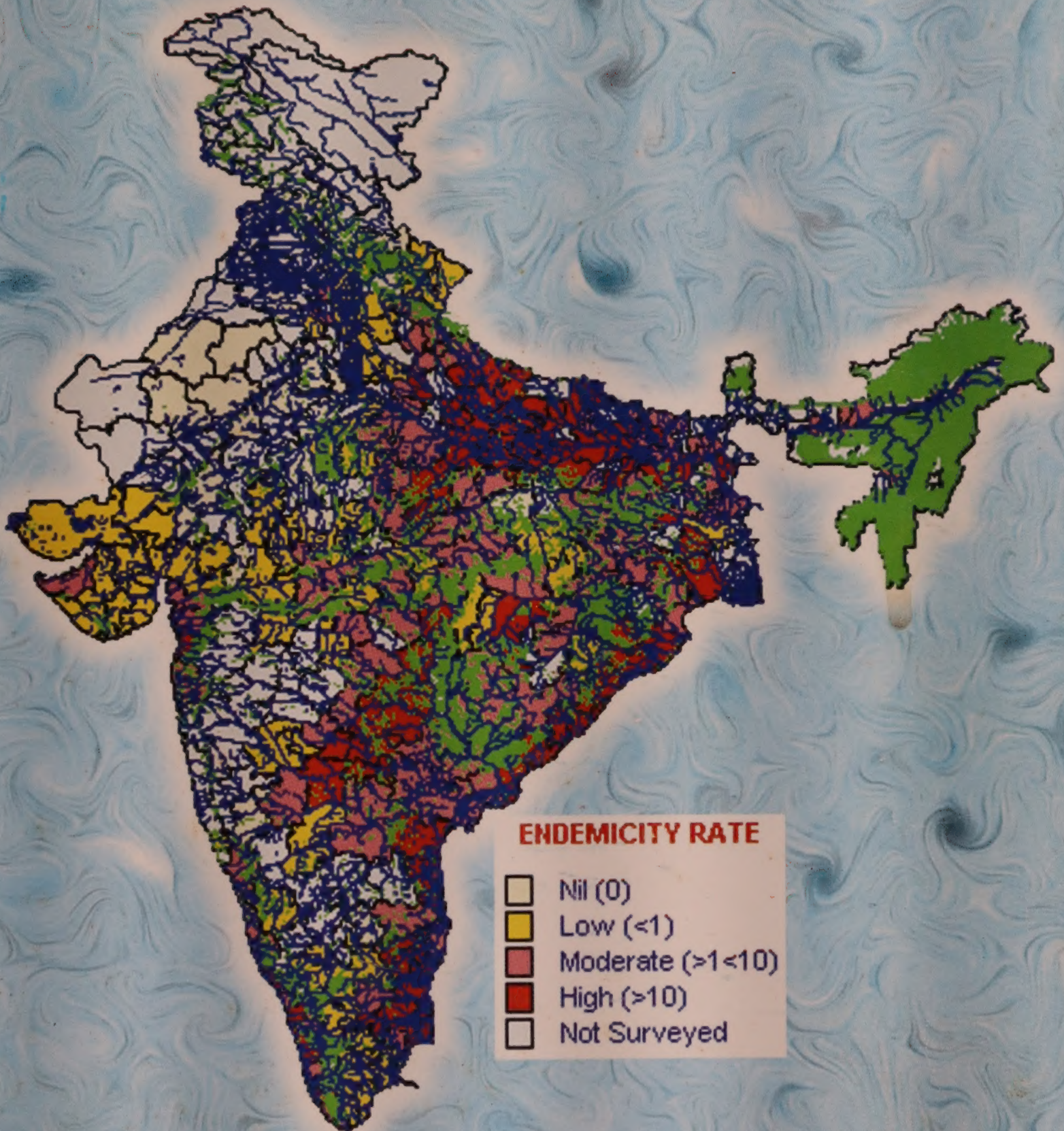









The Science and Art of Lymphatic Filariasis Elimination in India: Hopes for the next Millenium



ENDEMICITY RATE

-  Nil (0)
-  Low (<1)
-  Moderate (>1<10)
-  High (>10)
-  Not Surveyed

**Department of Public Health and Preventive Medicine,
Government of Tamil Nadu**

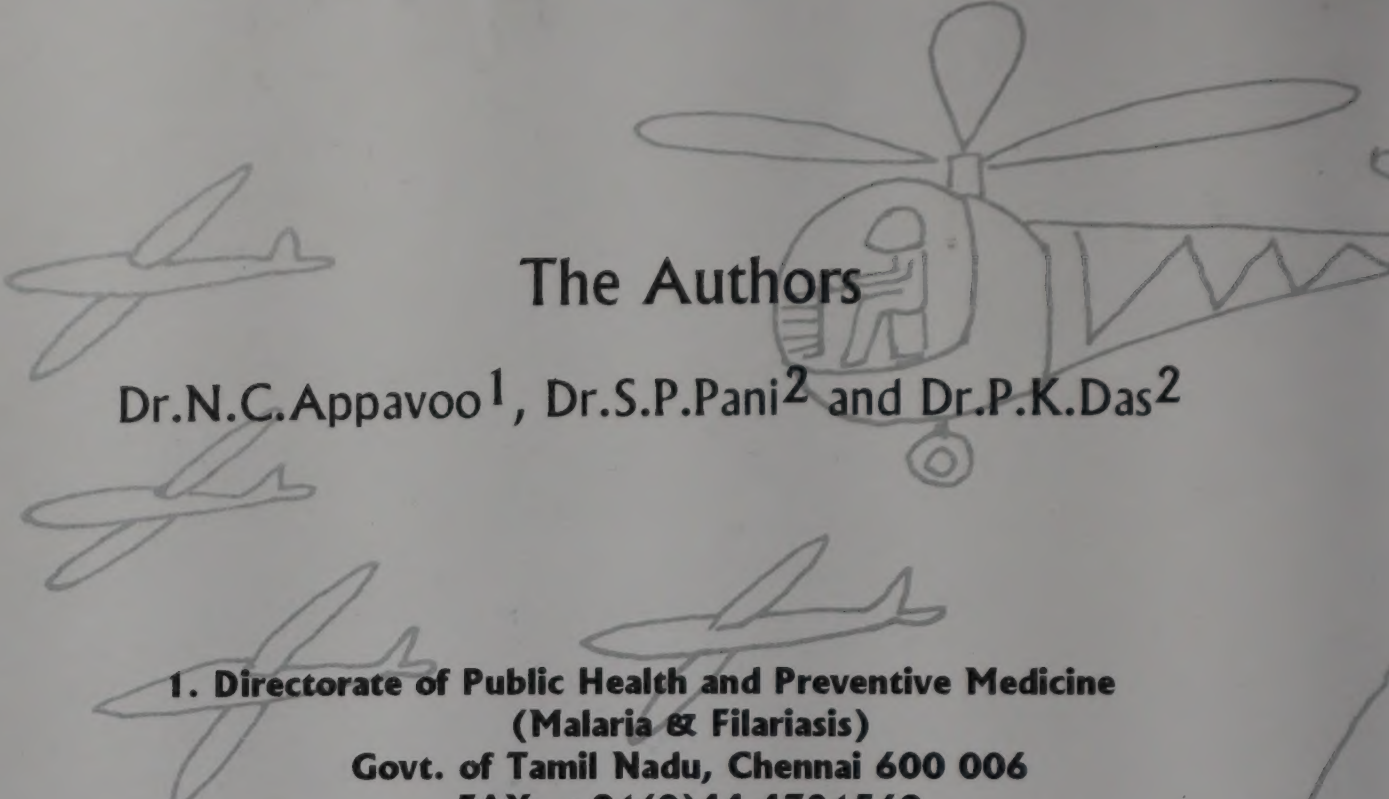


Vector Control Research Centre*

(Indian Council of Medical Research)
Pondicherry, India.



***World Health Organization**
*Collaborating Centre for Research & Training in
Integrated Methods of Vector Control.*



The Authors

Dr.N.C.Appavoo¹, Dr.S.P.Pani² and Dr.P.K.Das²

1. Directorate of Public Health and Preventive Medicine (Malaria & Filariasis)

Govt. of Tamil Nadu, Chennai 600 006

FAX: +91(0)44-4321569

e-mail: maya@tn.nic.in

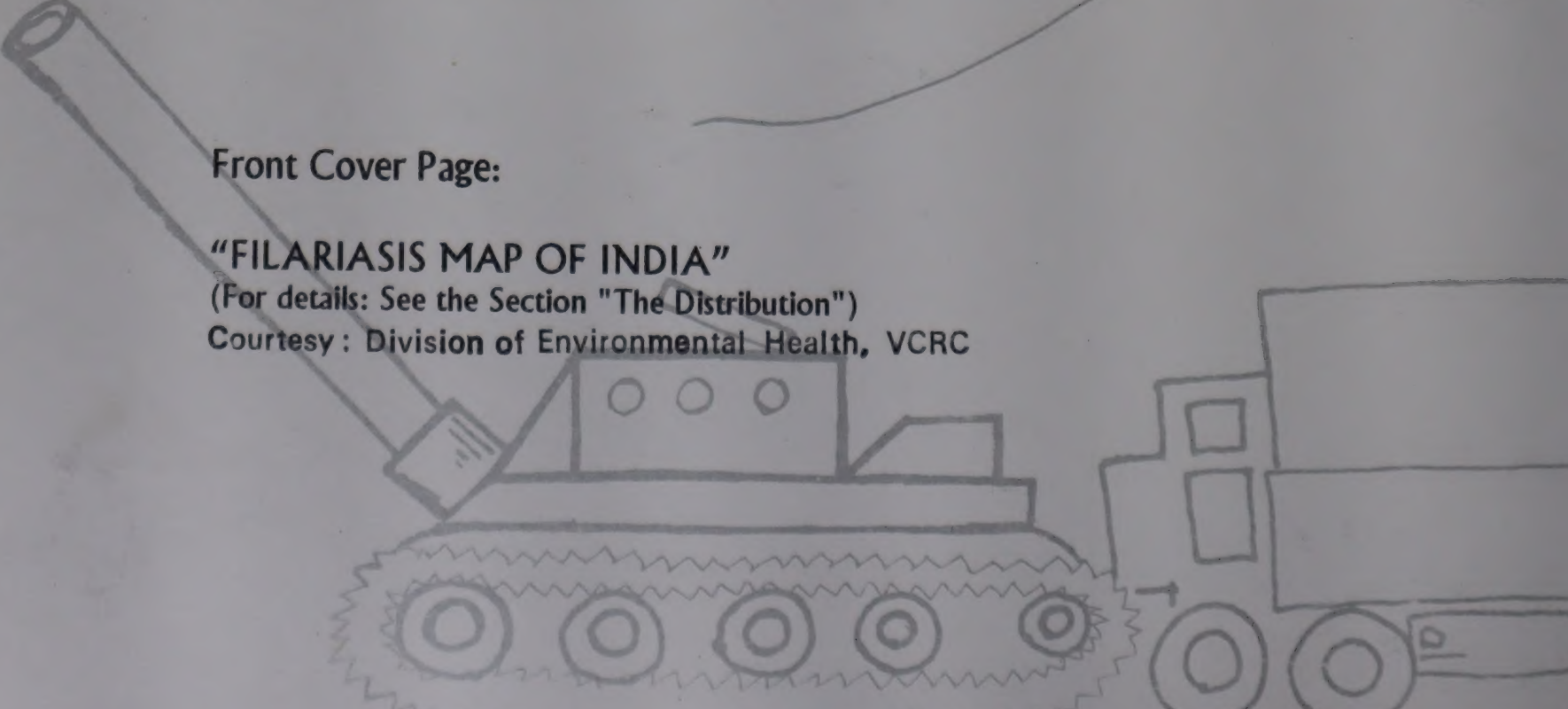
2. Vector Control Research Centre (Indian Council of Medical Research)

Indira Nagar, Pondicherry 605 006

FAX: +91(0)413-372041

e-mail: mosquito@md2.vsnl.net.in

Website: "<http://education.vsnl.com/vcrc/index.html>"



Front Cover Page:

"FILARIASIS MAP OF INDIA"

(For details: See the Section "The Distribution")

Courtesy : Division of Environmental Health, VCRC

The contributors

There are many who have directly or indirectly contributed to the technical contents of this document and for the formation of the "ICMR Cell - Towards elimination of filariasis in India".

Indian Council of Medical Research (ICMR) Head Quarters

Prof.N.K.Ganguly
Dr.Lalit Kant
Dr.Ravi Rangachary
Dr.Deepali Mukerjee
Dr.Rashmi Arora

Vector Control Research Centre (VCRC)

Ms.Ambili Kumar
Mr.A.Elango
Ms.A.Lakshmi
Ms.A.Srividya
Ms.B.Nanda
Mr.C.M.R.Reddy
Mr.C.Sadanandane
Dr.Dominic Amalraj
Ms.G.Vijayalakshmi
Dr.J.Yuvaraj
Mr.K.Balarajan
Dr.K.Balaraman
Dr.K.D.Ramaiah
Dr.K.Gunasekaran
Dr.K.Krishnamoorthy
Dr.K.N.Vijayakumar
Ms.K.S.Snehalatha
Dr.L.K.Das
Mr.M.Palaniyandi
Mr.N.Somachary
Dr.P.Jambulingam,
Mr.P.Vanamail
Mr.R.Dhanagopal
Dr.R.Lall,
Dr.S.Sabesan
Dr.S.LHoti
Mr.S.Subramanian

National Anti-Malaria Programme (for NFCP)

Dr.Shiv Lal
Dr.P.K.Srivastava
Dr.N.B.L.Saxena

Andhra Pradesh

Dr.K.S.V.Prasad Rao
Dr.G.Narayana
Dr.T.Gopal Singh

Bihar

Dr.Baldeo Singh

Gujarat

Dr.J.K.Anjan

Karnataka

Dr.P.N.Halagi
Dr.M.V.Murugendrappa

Kerala

Dr.V.K. Rajan
Dr.Ameena Ammal
Ms. Elsie Abraham

Orissa

Dr.J.K.Sahu
Dr.P.C.Burma
Dr.Satirani Sarap
Mr.A.K.Mohanty

Pondicherry

Dr.D.Thamma Rao
Dr.G.Subramanyam Reddy

Other ICMR Institutes

Dr.K.Satyanarayana, Bhubaneswar
Dr.G.P.Chotray, Bhubaneswar
Dr.M.D.Gupte, Chennai
Dr.P.R.Narayanan, Chennai
Dr.V.Kumarasami, Chennai
Dr.J.Mahanta, Dibrugarh
Dr.(Brig).R.S. Tiwari, Jabalpur
Dr.A.Gajanana, Madurai
Dr.S.K.Kar, Patna
Dr.S.C.Sehgal, Port Blair

National Institute of Communicable Diseases (NICD)

Dr.Jotna Sokhey
Dr.R.C.Sharma

Other Institutions

Prof. R.C.Mahajan
Dr. P.Nageswar Rao
Dr.K.N.Panicker
Dr.A.P.Dash
Prof.Shally Awasthi
Prof.R.K.Shenoy

Director General of Health Services

Dr.S.P.Agarwal

Oxford University

Prof.D.A.P Bundy
Dr. Edwin Michael

WHO/Geneva

Dr.Eric A.Ottesen
Dr.Gautam Biswas
Dr.Oladele O.Kale

Donors

Burroughs Wellcome (India) Ltd, Bombay
Serdia Pharmaceuticals, Bombay
Caplin Point, Pondicherry
Lions Club, Pondicherry

Dr.Keerthiseelan
Dr.L.Ganapathy
Dr.N.Vengatesvarlou
Mr.E.Murugasamy
Mr.K.Venugopal

Tamil Nadu

Dr.Paul Kandasami
Dr.D.J.Augustin
Dr.V.Kamalakaran
Dr.G.Palani
Dr.J.Prabakaran
Dr.A.Elango
Dr.C.Mani Arasu
Dr.R.T.Porkai Pandiyan
Dr.M.Selvaraju
Dr.R.Balasubramanian
Dr.S.Alphones Selvaraj
Dr.S.Harikrishnan
Dr.R.Meera
Dr.Md.Abdullah
Mr.T.Rajendran
Mr.T.Sarangapani
Mr.Abdul Kadhar
Mr.R.Gajapathi

Uttar Pradesh

Dr.G.K.Agarwal,
Dr.A.K.Dewivedi

Ministry of Health

Mr.M.Kannan

Erasmus Univesity

Prof.J.D.F. Habbema
Dr.A.P. Plaisier

WHO/SEARO/New Delhi

Dr.Chusak Prasittisuk

THE SCIENCE AND ART OF LYMPHATIC FILARIASIS ELIMINATION IN INDIA: HOPES FOR THE NEXT MILLENNIUM

IN SUMMARY

India accounts for 41% of global burden of lymphatic filariasis. The economic loss to India is to the tune of US \$ 1.5 billions per year. As a signatory to the World Health Assembly resolution on elimination of filariasis, India has already initiated action. The optimism and hope have their basis in the recent progress made in our understanding of the science of filariasis and its control, and the art of transferring this scientific knowledge to planners and implementors considering ground realities. Rapid epidemiological mapping using rapid assessment procedures (RAP) has been developed for stratification and allocation of areas for intervention. Mathematical models have been developed as a decision support tool for forecasting trends of transmission, infection and disease. The relative applicability of different intervention options in developing site-specific control strategy has been realized. Transmission control can be achieved through parasite or vector control or both. For parasite control, single annual dose of DEC can be given to the community in already identified endemic areas. DEC medicated salt can be introduced in clusters of villages identified by RAP. Area targeted vector control can be undertaken seasonally to consolidate the gains of drug action. Simple morbidity control measures can be undertaken in targeted pockets where disease prevalence is high. Newer diagnostic tools like ICT for antigenaemia and PCR for parasite DNA in mosquitoes collected using traps can be used for declaration of areas as 'non-endemic' as well as for certification of 'elimination'. This document proposes a strategic plan with four planning and implementation phases. The disappearance of infection in human and vector populations in seven villages in Tamil Nadu after the use of DEC medicated salt has indeed proved that elimination is not a dream but a reality.

WE UNDERSTAND



Microfilaria of
Wuchereria
bancrofti

The parasites

Wuchereria bancrofti and *Brugia malayi* are the two lymphatic dwelling nematode parasites causing filariasis in India, the former being responsible for over 95% of the problem.

The vectors in India

- *Culex quinquefasciatus* is the major vector of bancroftian filariasis
- *Mansonia* mosquitoes (*Mn. annulifera*, *Mn. uniformis*) transmit brugian filariasis



Culex quinquefasciatus

The disease

- Asymptomatic infection (sub-clinical lymphatic damage with high risk of developing disease at a later stage)
- Acute adenolymphangitis (ADL)
- Progressive lymphoedema leading to elephantiasis
- Hydrocele
- Tropical Pulmonary Eosinophilia (TPE)
- Renal damage resulting in haematuria
- Arthritis
- Endomyocardial fibrosis
- Others



A case of hydrocele



Acute adenolymphangitis (ADL)
in a case of lymphoedema

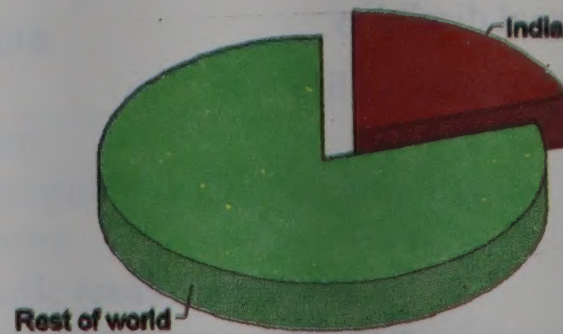
The problem in India

- 429 million people exposed to risk of infection
- 31.3 million microfilaria carriers
- 7.8 million lymphoedema / elephantiasis cases
- 12.9 million hydrocele cases

*India alone accounts for 42.8% of global problem due to *W.bancrofti* and 20.2% due to *B.malayi**



Global burden=106.2 million cases



Global burden = 12.9 million cases

Burden of bancroftian filariasis in India

Burden of brugian filariasis in India

The distribution

- Data compiled from the reports of the National Filariasis Control Programme (NFCP) for 280 districts surveyed until 1995 were used for the preparation of filariasis map of India using GIS platform (front cover page)
- The traditional endemic foci are situated around river basins, and eastern and western coastal areas
- Demographic changes and associated activities facilitate the spread of infection and disease to other areas
- Of the 25 States / Union territories surveyed in India, 22 are endemic
- Nine states (Andhra Pradesh, Bihar, Gujarat, Kerala, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal) contribute around 95% of overall burden

The burden

- Globally, filariasis is the second major cause of permanent disability
- Annual economic loss to India due to filariasis is to the tune of US \$ 1.5 billions

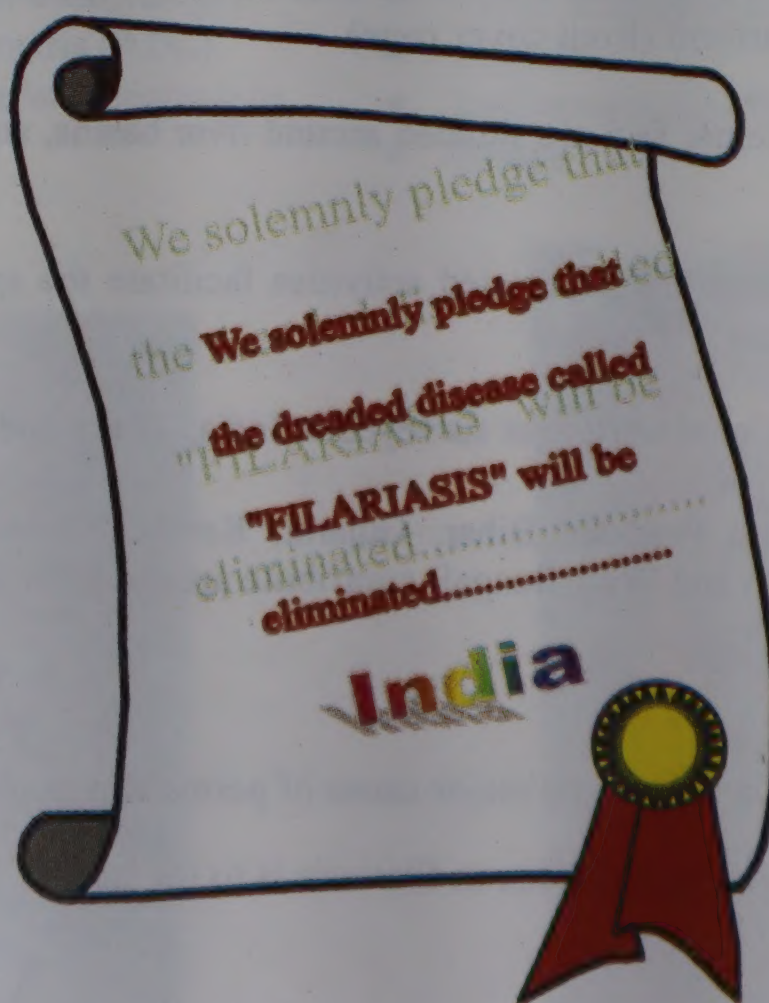
- Loss of income to individuals and families
- Loss of productivity
- Functional impairment and restricted mobility
- Social stigma and isolation, psychological stress and family discord
- Poor marriage prospects and employment opportunities
- Occupational displacement
- Sexual disability
- Poor quality of life



What a quality of life !

The commitment

*India is a signatory to the Resolution of the World Health Assembly (1997) for **"elimination of lymphatic filariasis as a public health problem"**. Realization of this political commitment using all the tools we have in our hands is now our duty. The knowledge and expertise we have on the science and art of elimination of filariasis are our strength to forge ahead.*



The aims

- Effective reduction of indigenous transmission to a level, at which new infections cease to occur
- Prevention of acute and chronic disease in children born after initiation of programme for elimination
- Prevention of acute and chronic disease in asymptomatic parasite carriers
- Prevention of repeated attacks of acute disease and arrest progression of chronic pathology in already diseased cases

The elimination of filariasis in India is possible

- Human beings are the only reservoir of infection
- Microfilaria stage of the parasites is highly susceptible to Diethylcarbamazine (DEC), the drug of choice as well as to Ivermectin
- Vector control can reduce transmission in specific areas / situations
- Simple measures of morbidity control can prevent / alleviate sufferings of the patients
- India has the required health infrastructure, technical and operational expertise
- India has eradicated Small pox and is on the verge of Guinea worm eradication. Polio immunization and Leprosy elimination are being realized. These experiences are of immense value for elimination of filariasis.

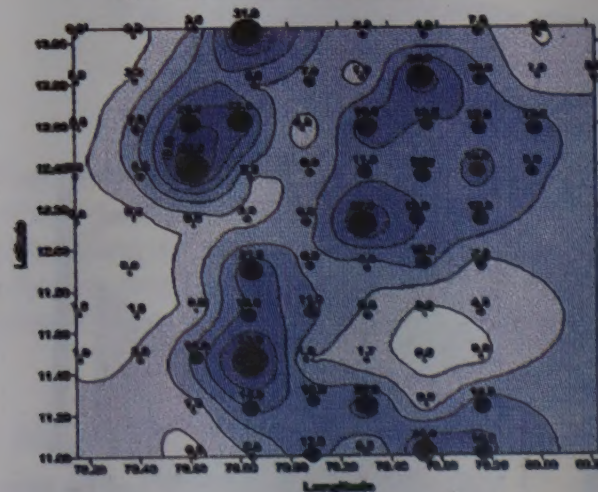
WE HAVE

Tools for mapping

- Tools for rapid epidemiological mapping using rapid assessment procedure (physical examination by health workers for filarial disease) and Geographic Information System (GIS) have been developed.

These can be used for rapid identification, stratification and allocation of areas for intervention.

Fig 6: Interpolation map for filarial disease

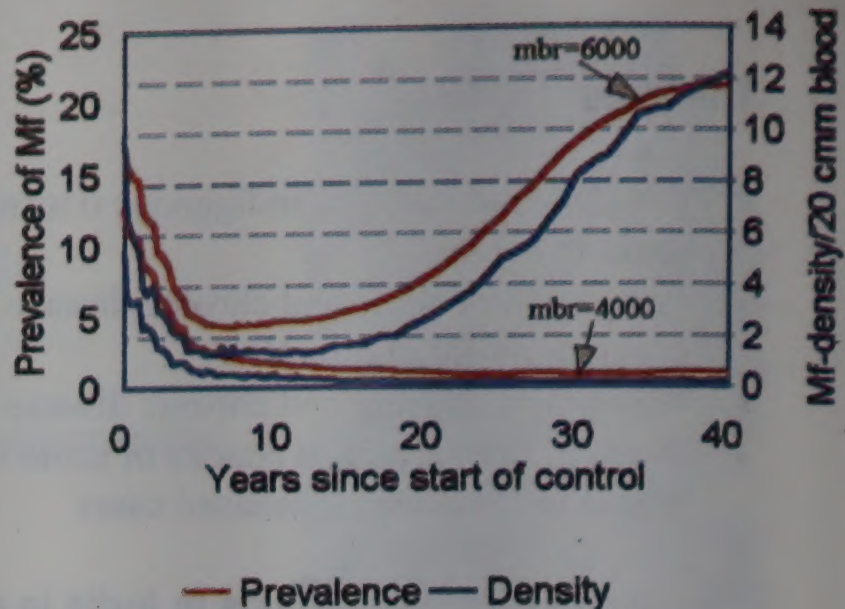


Interpolation map (contour) for distribution of scrotal swelling (hydrocele) prevalence in South India. Rapid epidemiological mapping has been useful to identify the hot spots (●) of disease (VCRC/WHO/TDR data)

Tools for decision support

- Two mathematical models: LYMFASIM using simulation approach and EPIFIL using deterministic approach are available
- Mathematical model for cost-effectiveness analysis has also been developed

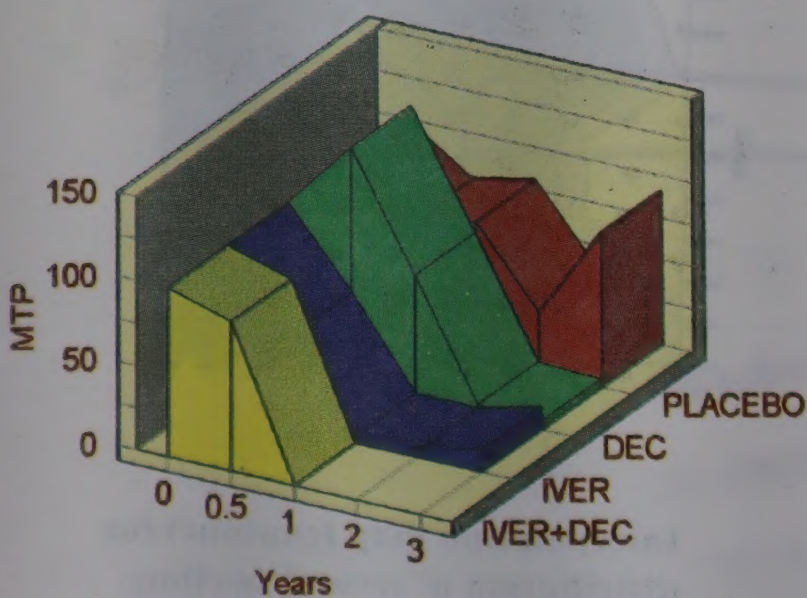
These can be used as decision support tools for optimization of interventions and prediction of their outcomes.



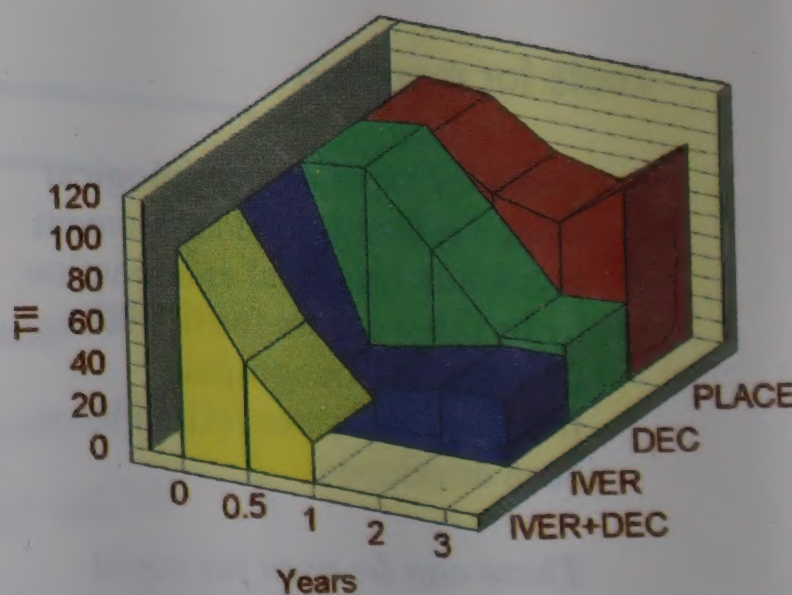
Prediction of trends in prevalence and density of microfilaria after 5 rounds of annual single dose DEC in two endemic situations with monthly biting rate (mbr) of 4,000 and 6,000, using LYMFASIM model

Tools for parasite control

- Diethylcarbamazine (DEC)
- Ivermectin



Comparison of relative efficacy of single dose DEC or Ivermectin (IVER) or combination of both on Monthly Transmission Potential (MTP) (VCRC/WHO/TDR data)



Comparison of relative efficacy of single dose DEC or Ivermectin (IVER) or combination of both on Transmission Intensity Index (TII) (VCRC/WHO/TDR data)

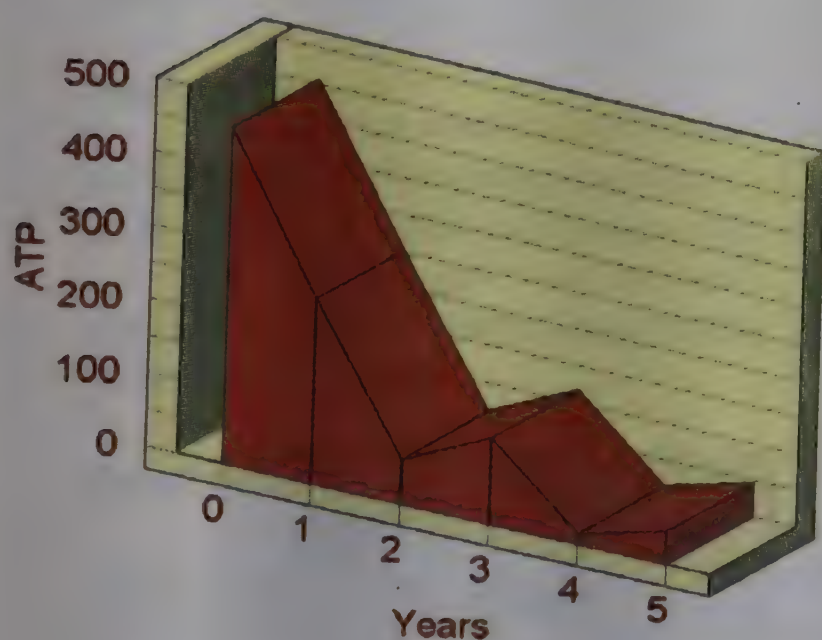
Different options of community drug delivery are

- ◆ Annual single dose of DEC (6 mg/kg of body weight) or Ivermectin (400 mcg/kg of body weight) or combination of both
- ◆ Semiannual single dose of DEC or Ivermectin or combination of both
- ◆ DEC fortified common salt (0.2 - 0.4 gm%)

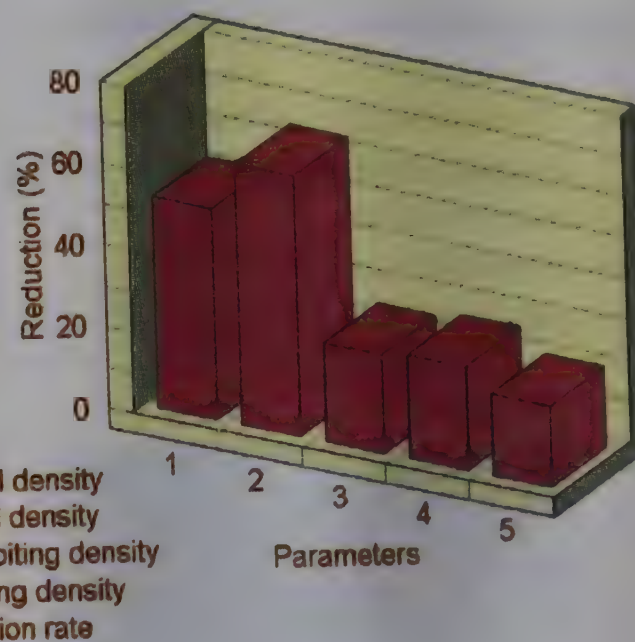
Both DEC and Ivermectin are highly effective microfilaricidal drugs. Use of these drugs at community level results in reduction of human infection and consequently transmission.

Tools for vector control

- Environmental management (modification / manipulation)
- Chemical insecticides
- Bio-larvicides (*Bacillus thuringiensis*, *B.sphaericus*)
- Repellant
- Mosquito net



Effect of integrated vector control on Annual Transmission Potential (ATP) of *Cx. quinquefasciatus*, vector of bancroftian filariasis in Pondicherry town (VCRC data)



Impact of *B. sphaericus* treatment on *Cx. quinquefasciatus* in Mayiladuturai, Tamil Nadu (VCRC data)

Vector control results in reduction of transmission by reducing vector density and / or survival, and man-vector contact. This can be a cost-effective tool if undertaken in specific areas / situations during peak transmission season. In areas, where effective reduction in transmission does not occur in spite of drug administration due to high vector density, vector control is essential.

Tools for morbidity control

For prevention of acute disease

- Footcare and hygiene in lymphoedema cases
- Local and systematic antibiotics, whenever required

For prevention of chronic disease

- Early detection and treatment of individual microfilaria carriers
DEC 6 mg / kg / day in three divided dosages for 12 days

For management of acute disease

Antibiotics

Anti inflammatory drugs

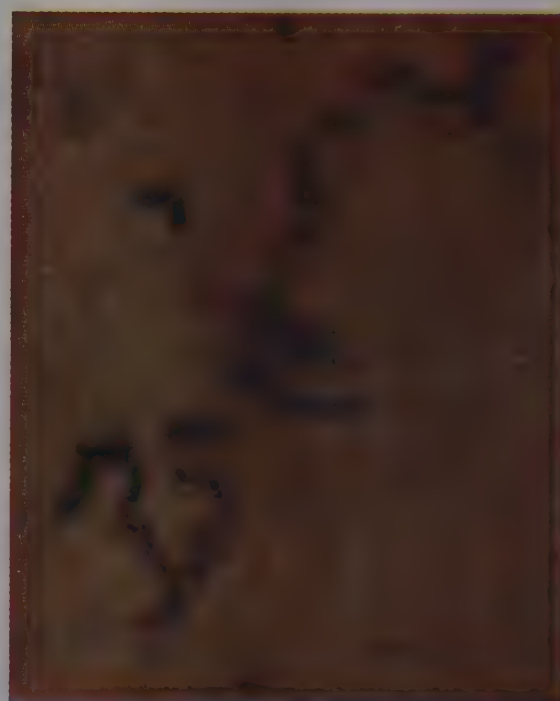
Symptomatic and supportive treatment

For management of lymphoedema

- Physiotherapy such as manual massage and pneumatic compression
- Repeated courses of DEC, particularly for early cases
- Surgical procedures such as lymphnode-venous shunt and excision of fibrous tissue
- Physical, psychological, social and occupational rehabilitation



Manual massage through patient to patient or partner to patient approach can be a realistic community based morbidity control strategy



Superinfection with bacteria (Group A *Streptococcus*) results in acute disease. Therefore antibiotics are essential for treatment of these attacks

For management of hydrocele

- Eversion and excision of sac by surgery

Morbidity control is targeted for individual patients. Antibiotics play an important role in management of acute disease, since secondary bacterial infection (particularly with Streptococci) are responsible for the attacks. Educating patients on foot hygiene and training them or their relatives on manual massage will be of practical value. Other morbidity measures will have to be undertaken at special treatment centres.

The strategic plan

An outline of the strategic plan with four implementation and planning phases is presented below. The planning in each stage will lead to implementation in the next stage.

Phase I

Implementation

Extend mass annual single dose DEC distribution (MASDDD) for a period of 5 years to all endemic districts identified using NFCD data

Initiate morbidity control measures in areas with high disease prevalence through community approach

Planning

Rapid epidemiological mapping for filariasis (REMFIL) of entire country using trained health workers to carry out physical examination of sample populations for the presence of filaria disease (scrotal swellings)

Identify areas with seasonal transmission using ecological criteria

Phase II

Implementation

Extend MASDDD to all the newer endemic areas identified by REMFIL

Extend morbidity control to newly identified endemic areas with high disease prevalence

Initiate DEC medicated salt programme for 3 years in clusters of villages with high disease prevalence as identified by REMFIL

Targeted seasonal vector control in areas identified during Phase I

Planning

In areas where disease prevalence is not recorded by health workers, carry out day blood antigen or night blood microfilaria test in sample populations

Phase III

Implementation

Extend MASDDD to newer areas with filarial infection identified by day blood antigen or night blood microfilaria test

Planning

In areas, where prevalence of disease and infection is not detected by health workers and day blood antigen test respectively, collect vector mosquitoes using traps and detect parasite infection by PCR or mosquito dissection

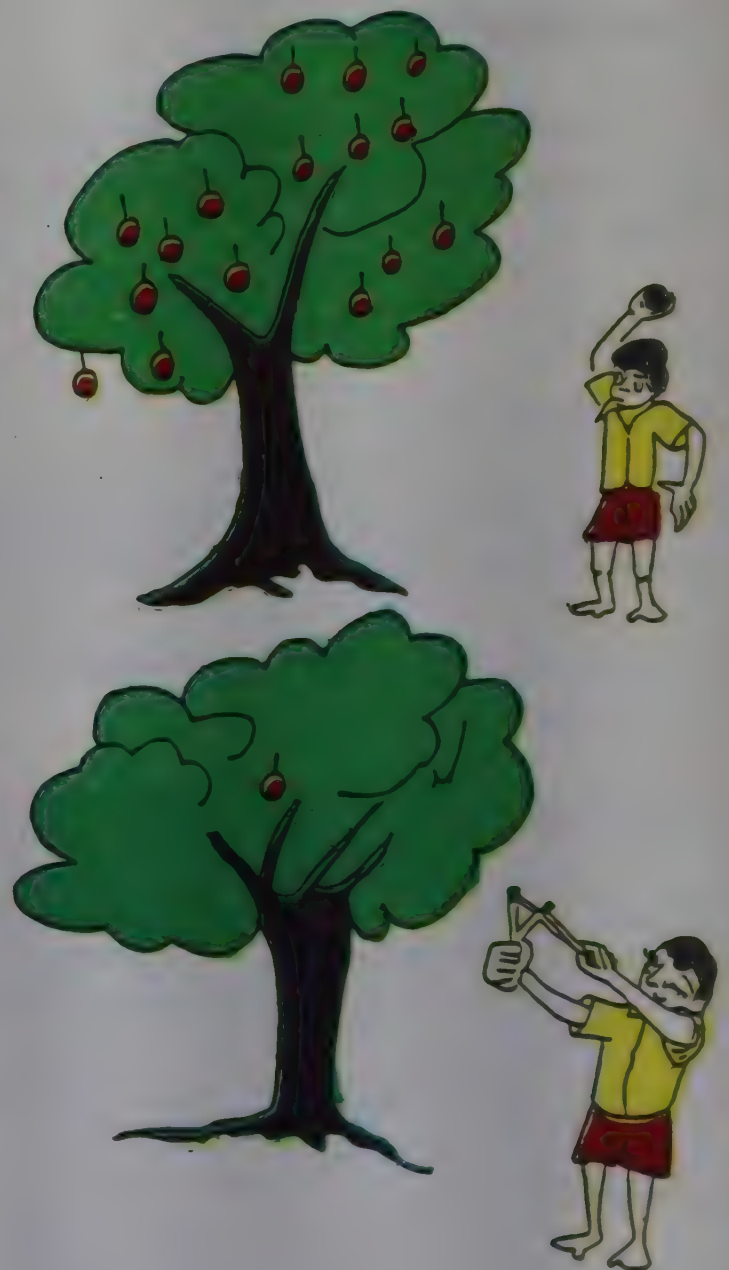
Review results of areas under MASDDD after 5 years or DEC salt after 3 years using transmission or human infection parameters

Phase IV

Implementation

Extend MASDDD to newer areas where transmission is detected by PCR or mosquito dissection

In areas under MASDDD or DEC salt decide extension or modification of strategy based on the review. Targeted approach like combination of DEC and Albendazole for control of filariasis and intestinal worms can also be carried out through school health programmes



The elimination strategy has to be site-specific. The choice of the tool(s) and the implementation process (for example: mass or targeted approach) will depend upon the distribution of disease and infection

Planning

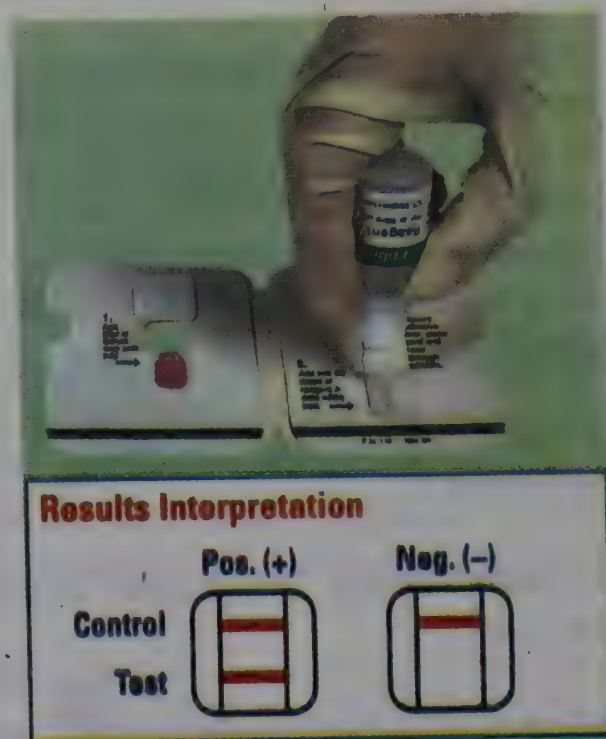
Declare the areas, where prevalence of disease, infection and transmission are not detected, as non-endemic

Keep vigilance for entry of new infections

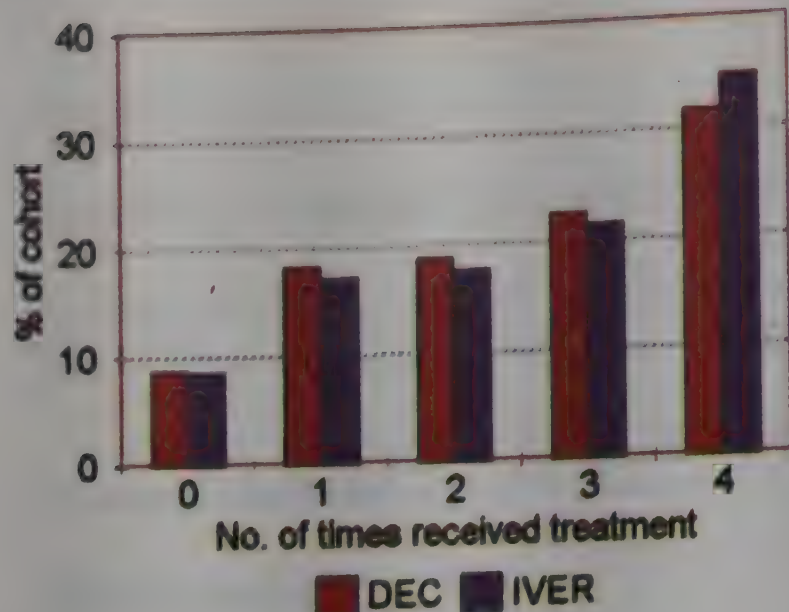
Areas under MASDDD or DEC salt, where infection and transmission are not detected (or reached to targeted level) can be considered for certification of elimination

The indicators

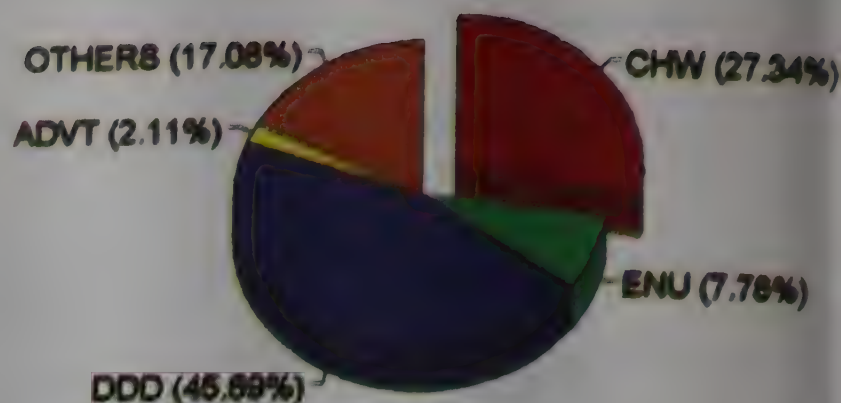
- Prevalence of disease is the primary indicator to be used for identification and stratification of endemic areas. Trained health workers at village level can carry out physical examination of sample population
- Prevalence of infection in human is the secondary indicator which can be used for identifying endemic areas. Day blood antigen test, if not, night blood examination for microfilariae can be carried out for detection of infection
- Coverage of distribution of drug and compliance of intake are important indicators for process evaluation
- Evaluation of information education and communication (IEC) methods (for community acceptance of programme and management of adverse reactions) by interviewing sample population is important
- Transmission parameters have to be used for certification of elimination



Day blood test for filarial antigens together with PCR for detection of vector infection will be of value for declaration of non-endemic areas as well as for certification of elimination



Compliance in terms of number of times received drug in cohorts of population at the end of 4 rounds of DEC (n=8543) and ivermectin (IVER) (n=7450) distribution (VCRC/WHO/TDR data)



CHW=Community Health Worker; ENU=During enumeration; DDD=During drug distribution; ADVT=through advertisements

Relative role of different Information Education and Communication (IEC) methods in creating awareness in the community about mass drug distribution programme in Cuddalore district, Tamil Nadu

The leaders

The leaders of this “elimination” process are the programme managers at National and State levels

National programme managers

- to draft policy statement
- to prepare strategic action plan
- to carry out advocacy at national level
- to carry out training activities at national level
- to mobilize national and international resources

State programme managers

- to draft site specific action plan
- to implement the plan in a phased manner
- to carry out training at state and district level
- to mobilize state and local resources

The supporters

The success of the elimination programme needs the active support of

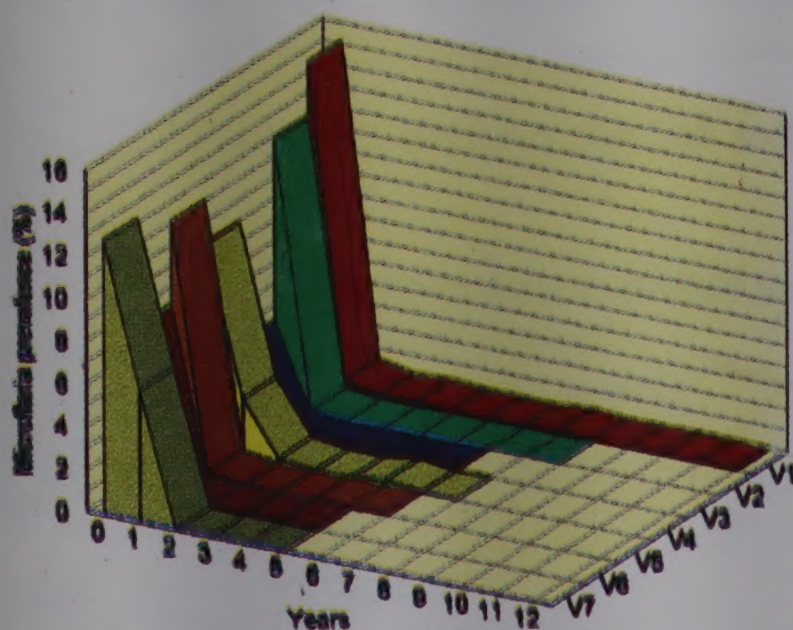
- Policy makers
- Non governmental organizations
- People's opinion leaders
- Press
- Donors
- Other government departments
- The community at large

The researchers

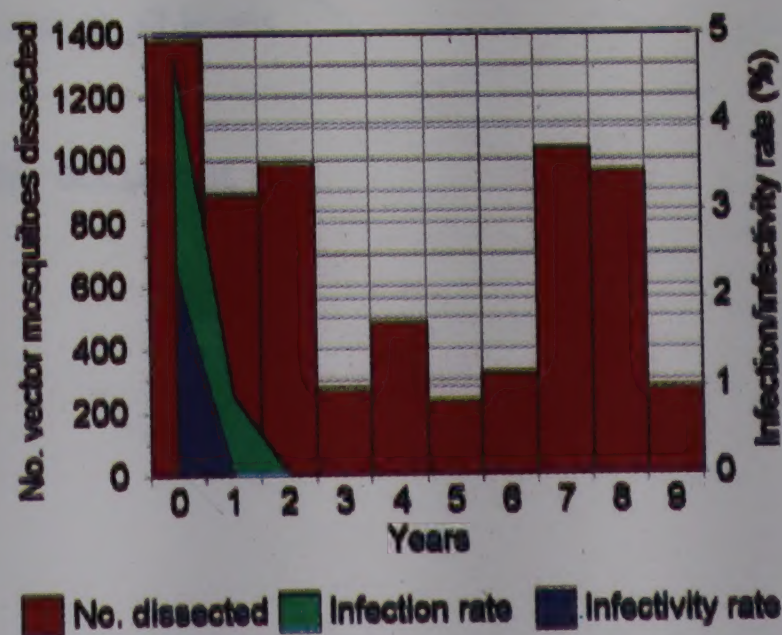
- Provide solutions to technical and operational questions raised by leaders and supporters
- Provide technical information and training as and when required

THE SUNSHINE OF HOPE

It is evident from a recent study in 7 villages of Tamil Nadu that irrespective of the level of initial infection prevalence, DEC medicated salt, when supplied through a decentralized distribution strategy, can result in elimination of human infection and interruption of transmission. The maximum period of intervention required for this achievement was 3 years. Indeed, it can be declared that filariasis has been eliminated from these villages, pending certification.



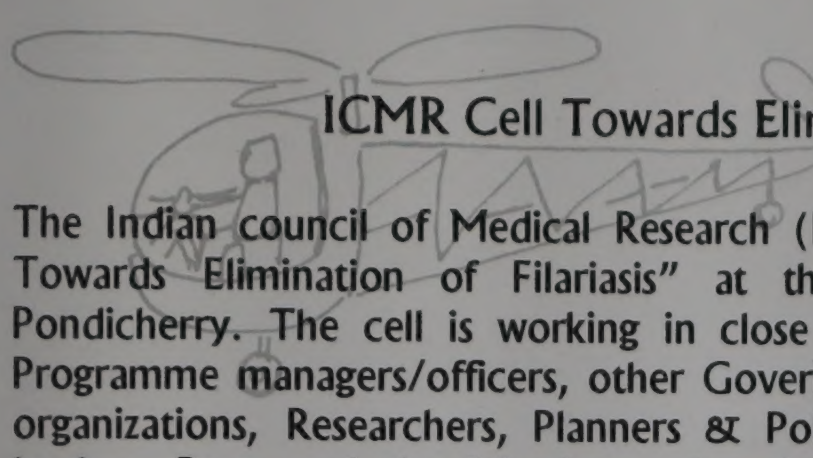
Effect of DEC medicated salt on microfilaria prevalence (%) in 7 villages (V₁-V₇) of Tamil Nadu (data: DPH, Tamil Nadu)



Effect of DEC medicated salt on mean vector infection and infectivity rates in 7 villages of Tamil Nadu (data: DPH, Tamil Nadu)

THE MESSAGE

By signing the World Health Assembly resolution on elimination of lymphatic filariasis, India has launched the war against this scourge. We have the knowledge, infrastructure, technical and implementation expertise with us to march ahead. The arms we have in our hands and the willpower we have in our commitment give us the confidence that we will definitely win this war. Filariasis shall be eliminated from the face of India.



ICMR Cell Towards Elimination of Filariasis

The Indian council of Medical Research (ICMR) has established an "ICMR Cell Towards Elimination of Filariasis" at the Vector Control Research Centre, Pondicherry. The cell is working in close collaboration with the National/State Programme managers/officers, other Government departments, Non-governmental organizations, Researchers, Planners & Policy makers, Donors, People's opinion leaders, Press and the Members of endemic community at large to meet the following objectives:

- to provide technical information on filariasis and its control to all concerned,
 - to facilitate the formulation of a policy statement and preparation of strategic plan,
 - to facilitate advocacy steps at all levels,
 - to foster effective linkages with all partners,
 - to facilitate mobilization of resources,
 - to assist programme personnel in the development and implementation of site-specific strategy,
 - to develop tools and designs for monitoring and evaluation of the programme,
 - to facilitate required training and human resource development and
 - to facilitate the documentation of the process at all levels.
-

For Correspondence regarding the Cell and this document

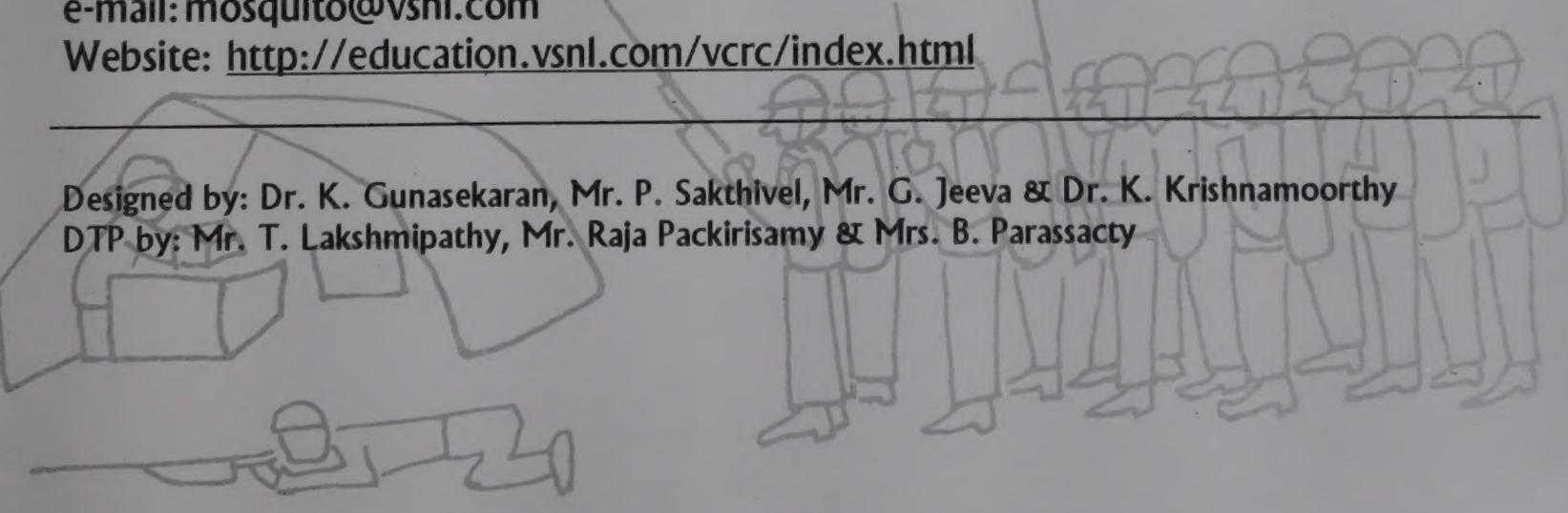
The Convenor
"ICMR Cell towards Elimination of Filariasis"
Vector Control Research Centre
(Indian Council of Medical Research)
Medical Complex, Indira Nagar,
Pondicherry 605 006. INDIA

FAX: 0413-372041

e-mail: mosquito@vsnl.com

Website: <http://education.vsnl.com/vcrc/index.html>

Designed by: Dr. K. Gunasekaran, Mr. P. Sakthivel, Mr. G. Jeeva & Dr. K. Krishnamoorthy
DTP by: Mr. T. Lakshmipathy, Mr. Raja Packirisamy & Mrs. B. Parassacty



About this publication

This publication entitled **"The science and art of filariasis elimination in India: hopes for the next millenium"** is published under the auspices of **"ICMR cell towards Elimination of filariasis in India"**. In the wake of the next millenium, India is prepared to move from its political commitment on filariasis elimination (as a signatory to the World Health Assembly Resolution on the global elimination of filariasis, 1997) towards bold action at all levels with due consideration of the ground realities. This document consolidates the rich technical knowledge and field experience gathered in India, which has led to the hope that filariasis elimination in India can be a reality. We expect that this document will serve as **a starting point for dialogue, discussion and debate leading to the formulation of a National Policy and a strategic plan**. Therefore, we request all those concerned and interested in eliminating the Scourge of filariasis from the face of India, to add, comment and criticize this document freely, **so that a consensus is ultimately reached to enable us to move unitedly towards our goal**.

Infact, many grass root level workers, peripheral & district level health personnel, State & National programme officers & managers, personnel from other Government departments, Non-governmental organizations, Researchers, Planners & Policy makers, Donors, People's opinion leaders, Press and the Members of the endemic community have been working tirelessly for filariasis control in India. The content of this document indeed reflects their rich experience and therefore it is our belief that this document will instill enough self confidence at all levels to forge ahead in our war against the filariasis scourge. **The war has indeed begun and we shall by all means win it with our united arms.**

**The Authors &
Contributors**